AN: PAT 1996-344166
TI: Portable remote control device esp. for operating vehicle has radio and infrared or ultrasonic transmitter and user inputs to operate control circuitry, transmitting two different signals which activate different functions
PN: **GB2297667**-A
PD: 07.08.1996
AB: The portable remote control device communicates with a base station. It includes a radio transmitter and an infra-red or ultrasonic transmitter. A control circuit is operated by user inputs, e.g. push-buttons to send two different signals via the radio and infra-red links respectively to a base station. Pref, the user input consists of a mode switch which the user uses to choose which signal to send over which type of link, and a command switch which is used to activate the desired signal. The remote control device is pref. housed in a casing which can be held and operated with one hand.; For activating functions on vehicle, e.g. starting engine and operating doors, windows or ramps. Allows some functions to be activated from distance such as starting engine to allow it to warm up, while ensuring other functions which could harm passers-by must be activated from within sight. Prevents passers-by from being hit by suddenly opening doors or descending ramp.
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IN: PAGE B F;
FA: **GB2297667**-A 07.08.1996;
CO: GB;
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MC: S05-K; W05-D04; W05-D07D; X22-A08A; X22-X05;
DC: S05; W05; X22;
FN: 1996344166.gif
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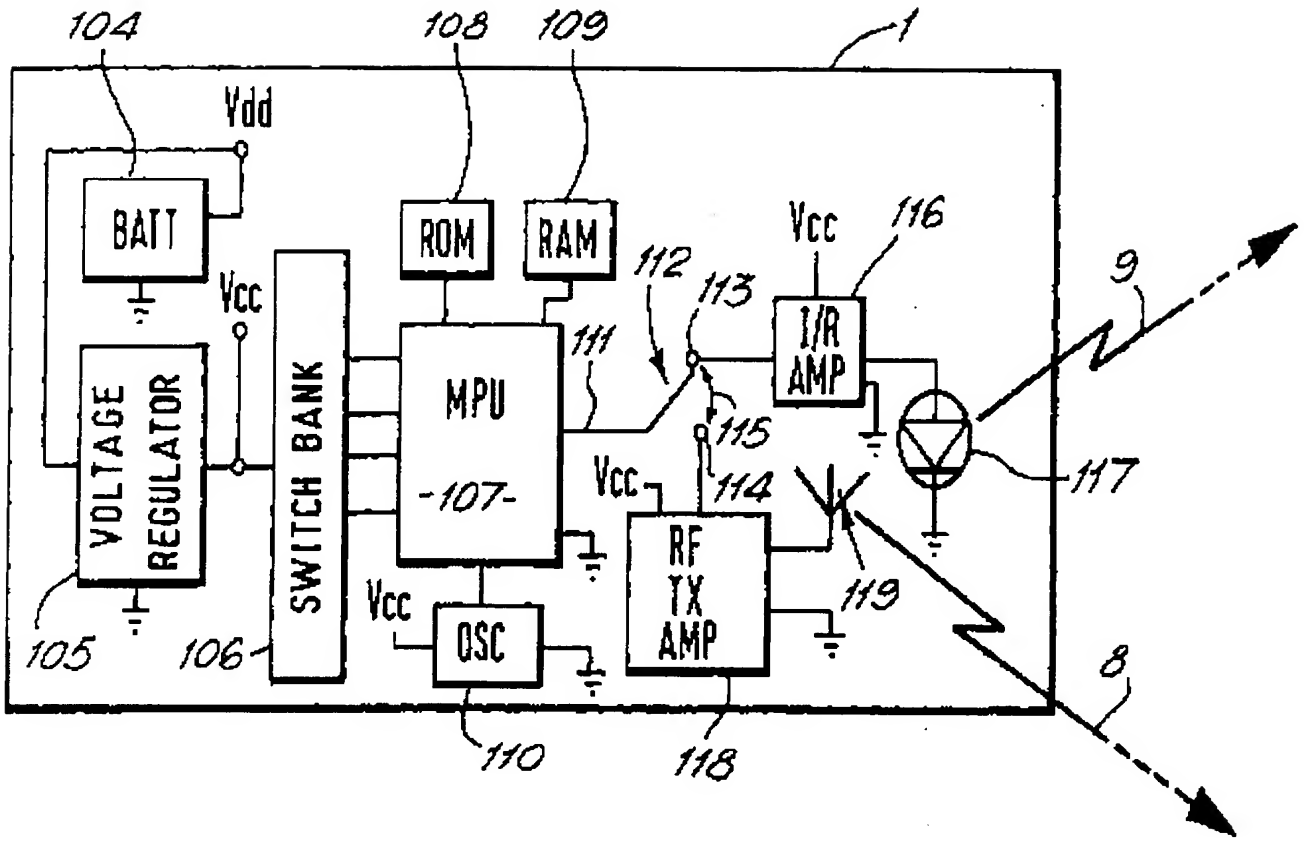
FP: 07.08.1996
UP: 26.08.1996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GB 1426492 A **DE 004300600 A** **US 5138649 A**

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(54) Portable control device with multi-mode transmission

(57) A user, e.g. a disabled person in a wheelchair, may remotely control vehicle functions of a vehicle (3) by using a portable hand-held control device (1). From a comparatively long distance, a command may be sent via a radio link (8) to a base station (2) fitted to the vehicle so as to, for example, instruct the vehicle electronics to start the vehicle engine (4), thereby to warm up the vehicle before the disabled person arrives at the vehicle. Further commands may be sent by an infra-red or ultrasonic link (9) in order to control vehicle functions, such as opening a door (5) or lowering a ramp (6), that need the user to be within sight of the vehicle to ensure that those vehicle operations do not accidentally hurt passersby or passing vehicles. Preferably, any command sent via the infra-red or ultrasonic link (9) has the effect of cancelling any command previously sent via the radio link (8), so that, for example, the user is not able to enter the vehicle whilst the engine is still running. This helps to prevent any unintended engagement of the transmission from causing premature movement of the vehicle.

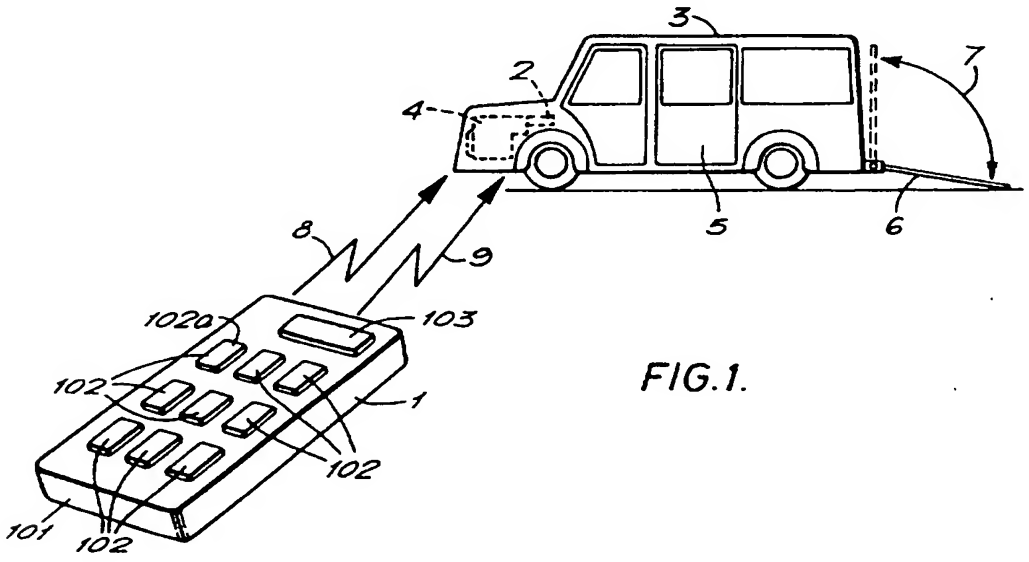

FIG.1.

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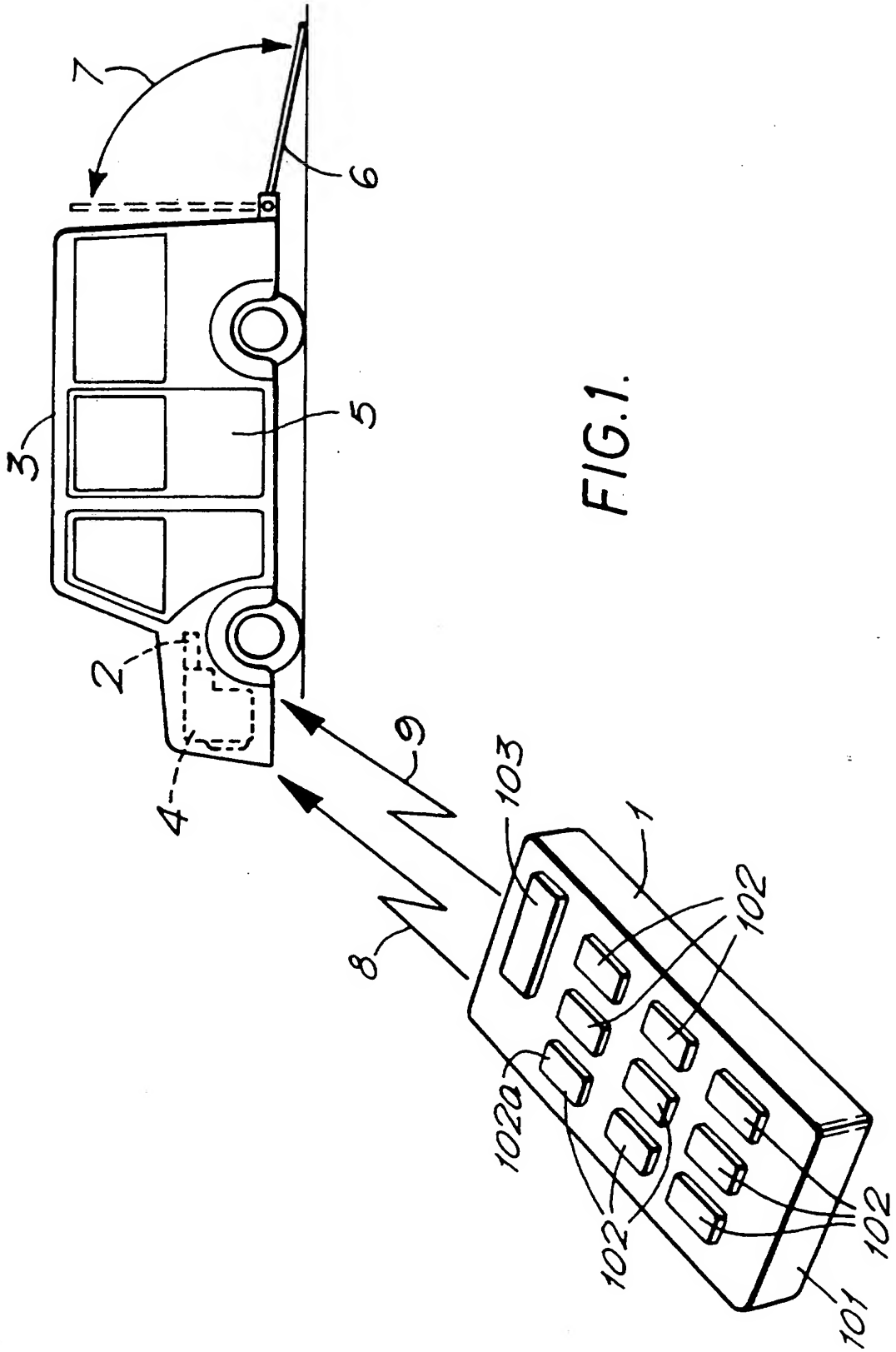

FIG.1.

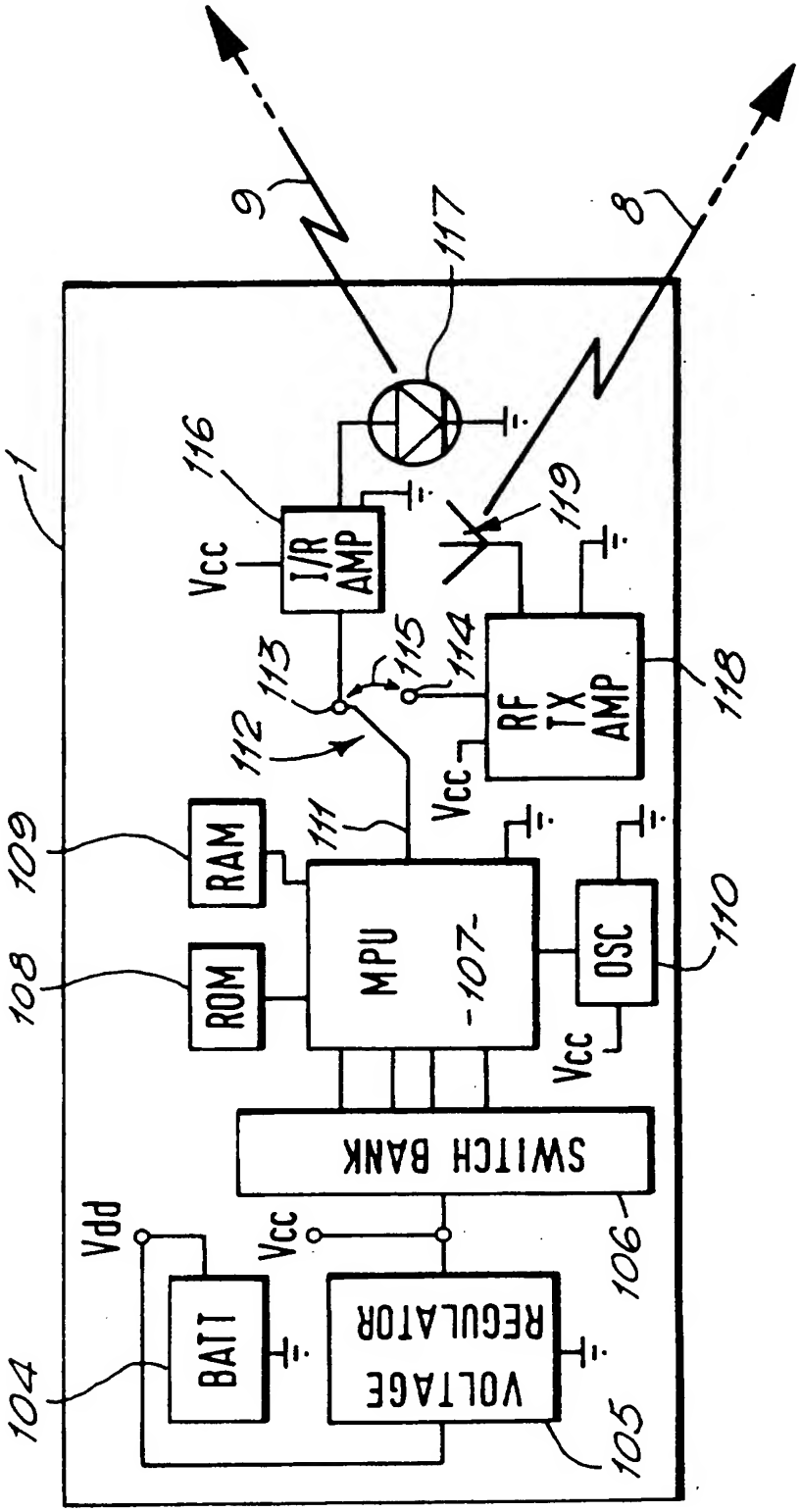

FIG. 2.

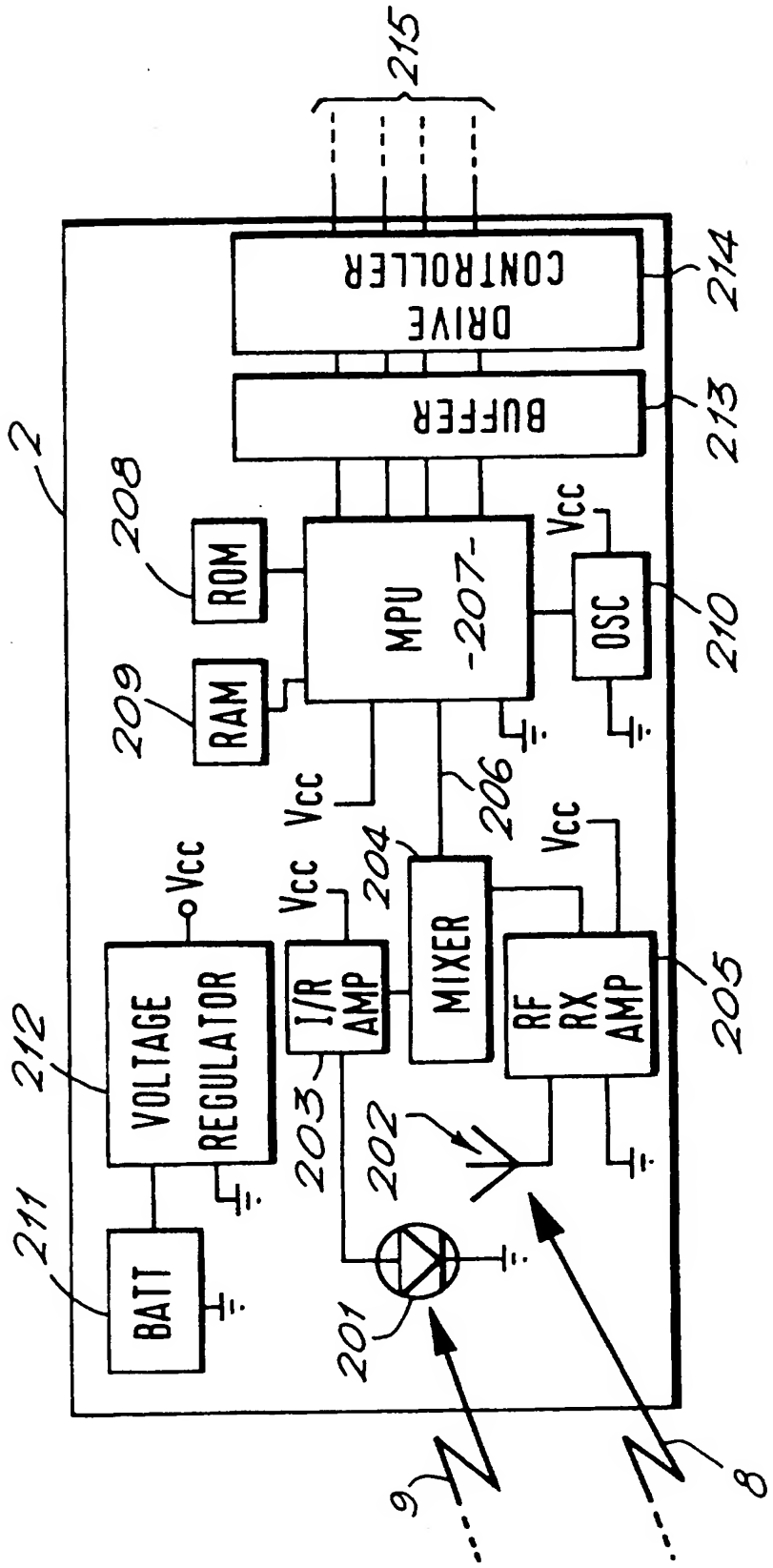

FIG. 3.

PORTABLE CONTROL DEVICE WITH MULTI-MODE TRANSMISSION

The invention relates to a portable control device for communicating with a base station via multiple types of communication link. The invention also relates to a control system incorporating such a portable control device and a base station; a combination of a vehicle and such a control system; a method of communicating between a portable control device and a base station; a method of controlling the output of a base station by using such a communication method; and a method of remotely controlling a vehicle by using such a communication method.

It is known to provide a disabled person with a hand-holdable control device or unit for remotely controlling functions of a vehicle. There may be a radio link between the control device and a base station in the vehicle so that the disabled person can use the control device, for example, to remotely switch on the engine of the vehicle so as to warm up the vehicle before it is used. A radio link offers comparatively long range and the disabled person does not have to be in line-of-sight of the vehicle.

Other vehicle functions may be controlled, such as opening and closing a vehicle door, or raising and lowering an access ramp.

As an alternative to a radio link between the control device and the base station in the vehicle, an infra-red link may be used. Generally speaking, an infra-red link has a shorter range than a radio link and does require line-of-sight operation. In other words, the vehicle must be visible to the disabled person and there must be no obstructions between them.

If a radio link is used to control the vehicle functions of opening and closing a vehicle door, or raising and lowering a vehicle ramp, the long range capability of the radio link, and the fact that the vehicle may be out of sight of the disabled person operating the control device, means that a passerby could

be injured by the vehicle door as it suddenly opens or by the access ramp as it is suddenly lowered. There is also the possibility of damaging a passing vehicle.

According to a first aspect of the present invention, there is provided a portable control device for communicating with a base station, the portable control device comprising: a first, radio transmitter; a second, infra-red or ultrasonic transmitter; first control circuitry; and input means operable to input a first input signal to the first control circuitry and operable to input a second input signal to the first control circuitry; wherein the first control circuitry is responsive to the first input signal to cause the first transmitter to transmit a first command signal and is responsive to the second input signal to cause the second transmitter to transmit a second command signal.

In a practical embodiment, the portable control device could be used by a disabled person to communicate with a base station fitted to a vehicle, in order to control vehicle functions such as starting the vehicle's engine and opening and closing a vehicle door. The first command signal, transmitted via the radio link, could be used to command the base station to start the vehicle engine. The second command signal, transmitted via the infra-red or ultrasonic link, could be used to command the base station to open the vehicle door. There is a significant benefit from having two modes of transmission (the radio link, and the infra-red or ultrasonic link) between the portable control device and the base station. The radio link enables the user to start the vehicle engine from a long distance, without having to be in sight of the vehicle. The action of starting the vehicle engine is most unlikely to harm a passerby, or damage a passing vehicle. By allocating the control of vehicle functions which could injure a passerby, or damage a passing vehicle, to the infra-red or ultrasonic link, the user has to be relatively close to the vehicle and able to see the

vehicle. Thus, the user will be able to delay performing a potentially dangerous vehicle function until it is safe to do so.

In one embodiment, the input means comprises first and second command switches operable to input the first and second input signals, respectively, to the first control circuitry. This would enable each command switch to be dedicated to controlling a single vehicle function.

However, a more preferable arrangement is one in which the input means comprises a command switch and a mode switch which is operable to switch the portable control device between first and second operational modes, and the command switch is operable, when the portable control device is in its first operational mode, to input the first input signal to the first control circuitry and is operable, when the portable control device is in its second operational mode, to input the second input signal to the first control circuitry. Because each command switch is able to trigger the sending of command signals which may be used to control two different vehicle functions, the portable control device needs only half the number of command switches that are necessary when each command switch is dedicated to only a single command signal and a single associated vehicle function.

The portable control device may be fixed to a disabled person's wheelchair, but it is preferable that instead it further comprises a casing which is holdable in a user's hand and is disposed around the first and second transmitters, the first control circuitry and the input means. Conveniently, the input means is arranged relative to the casing so as to be operable by a user's hand when that hand is holding the casing.

According to a second aspect of the present invention, there is provided a control system comprising a portable control device according to the first aspect of the present invention and a base station, wherein the base station comprises: a first, radio receiver; a second, infra-red or ultrasonic receiver; and

second control circuitry which is responsive to the first receiver receiving the first command signal to output a first control signal and is responsive to the second receiver receiving the second command signal to output a second control signal.

Preferably, the second control circuitry is responsive to the second receiver receiving the second command signal to cancel the first control signal.

In a practical embodiment, where the base station is fitted to a vehicle and the second control signal is used to open a vehicle door, and the first control signal is used to start the vehicle's engine, it is likely that in practice the first control signal will be outputted by the base station before the base station receives the second command signal and outputs the second control signal. This is because a user is likely to want to start the vehicle engine before getting sufficiently close to the vehicle to be able to use the infra-red or ultrasonic link to open the vehicle door. By cancelling the first control signal, so as to switch off the vehicle engine, at the same time as outputting the second control signal, to open the vehicle door, it is possible to ensure that the user is not able to enter the vehicle whilst the engine is still running. This helps to prevent accidents from happening, such as might happen if the user accidentally moves the automatic transmission of the vehicle to "Drive" when entering the vehicle. With the preferred feature just mentioned, the user must restart the vehicle engine in the normal manner, after entering the vehicle.

According to a third aspect of the present invention, there is provided a combination of a vehicle and a control system according to the second aspect of the present invention, wherein the base station is fitted to the vehicle and the vehicle is responsive to the first control signal to perform a first vehicle function and is responsive to the second control signal to perform a second vehicle function.

According to a fourth aspect of the present invention, there is provided a method of communicating between a portable control device and a base station, wherein command signals are transmitted from the portable control device to the base station via a radio link and an infra-red or ultrasonic link and the portable control device allocates each command signal to one of the links.

Preferably, the portable control device has a first operational mode in which command signals are allocated only to the radio link and a second operational mode in which command signals are allocated only to the infra-red or ultrasonic link, and during transmission of the command signals a mode switch is operated so that the portable control device is switched between the first and second operational modes.

Preferably, the portable control device has a plurality of command switches each of which is operable to trigger the transmission of (i) a respective one of a group of first command signals when the portable control device is in its first operational mode and (ii) a respective one of a group of second command signals when the portable control device is in its second operational mode, and during transmission of the command signals the or each one of at least one of the command switches is operated when the portable control device is in each mode.

In this way, a given number of command switches are able to transmit twice that number of command signals. In a practical embodiment, where the base station is fitted to a vehicle, a given number, e.g. eight, of command switches are able to control twice that number, e.g. sixteen, of the vehicle's functions.

Preferably, during transmission of the command signals the portable control device is held in a user's hand. Preferably, the user's hand that is holding the portable control device is also used to operate the mode and command switches.

According to a fifth aspect of the present invention, there is provided a method of controlling the output of a base station, comprising: transmitting command signals from a portable control device to the base station by using a method according to the fourth aspect of the present invention; and responding to the command signals by outputting control signals from the base station.

Preferably, the base station responds to a command signal transmitted via the infra-red or ultrasonic link by cancelling control signal(s) previously outputted in response to command signal(s) transmitted via the radio link. With this preferred feature, as explained above, a command transmitted via the infra-red or ultrasonic link to open a vehicle door may also have the effect of cancelling a previous command transmitted via the radio link to start the vehicle engine.

According to a sixth aspect of the present invention, there is provided a method of remotely controlling a vehicle, comprising: transmitting command signals from a portable control device to a base station fitted to the vehicle, by using a method according to the fourth aspect of the present invention; and responding to the command signals by performing respective vehicle functions.

Preferably, one of the vehicle functions comprises opening a door of the vehicle and another one of the vehicle functions comprises starting an engine of the vehicle.

Preferably, the command signal for the vehicle function of opening the door of the vehicle is transmitted via the infra-red or ultrasonic link, and the command signal for the vehicle function of starting the engine of the vehicle is transmitted via the radio link.

Preferably, in response to a command signal transmitted via the infra-red or ultrasonic link, vehicle function(s) performed

previously in response to command signal(s) transmitted via the radio link are cancelled.

Stated broadly, with the present invention, a portable control device sends a first command signal (e.g. for a non-safety critical function) via a long-range, non-line-of-sight link and sends a second command signal (e.g. for a safety critical function) via a short-range, line-of-sight link. Thus, if there is an obstruction between the portable control device and the associated base station, the base station will be able to receive and act on the first command signal but not the second command signal.

A non-limiting embodiment of the present invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is a diagrammatic view of a combination of a vehicle and a control system, according to the present invention;

Figure 2 is a circuit diagram of a portable control device of the control system of Figure 1; and

Figure 3 is a circuit diagram of a base station of the control system of Figure 1.

Referring to Fig. 1, the control system comprises a hand-holdable control device 1 and a base station 2 which is fitted in a vehicle 3. The base station 2 interfaces with the vehicle electronics so as to be able to control a number of vehicle functions, such as switching on and off a vehicle engine 4, opening and closing a vehicle door 5 and raising and lowering a vehicle ramp 6. In Fig. 1, the lowered position of the ramp 6 is shown in full line, and the raised position of the ramp 6 is shown in dotted line. Movement between the raised and lowered positions is indicated by arrow 7.

Between the control device 1 and the base station 2, there is a radio link indicated by arrow 8, and an infra-red link indicated by arrow 9.

The control device 1 comprises a casing 101 through which project a bank of command switches 102 and a mode switch 103. Nine command switches 102 are illustrated in Fig. 1 but a different number may be provided, depending on the number of vehicle functions that it is desired to control. Each command switch 102 is associated with controlling two vehicle functions. The mode switch 103 is used to switch between the two different transmission modes that are possible between the control device 1 and the base station 2. One of the transmission modes involves sending all command signals only via the radio link 8. The other transmission mode involves sending all command signals only via the infra-red link 9. Each command switch 102 is capable of causing a command signal to be transmitted in each transmission mode. Because each command signal controls a respective vehicle function, the illustrated nine command switches 102 are capable of controlling eighteen vehicle functions. This makes the control device 1 more compact than if there is only a single transmission mode, in which case eighteen command switches would be required.

The electronics of the control device 1 are contained within the casing 101 and Fig. 2 is a circuit diagram of the electronics. A battery 104 outputs an unregulated supply voltage Vdd which is fed to a voltage regulator 105 in order to produce a regulated supply voltage Vcc which is used to supply power to various components as illustrated in Fig. 2. The switch bank 106 comprises the command switches 102 and the mode switch 103. Input signals produced by depressing the switches of the switch bank 106 are fed into a microprocessor unit 107 which operates under the control of software stored in a ROM 108 and makes use of a RAM 109 when running the software. An oscillator 110 produces a clock pulse which is used to regulate the functioning of the MPU 107. An output 111 of the MPU 107 is fed to a

switch 112 which is movable between contacts 113, 114. The possible movement of the switch 112 is indicated by arrow 115.

Contact 113 is connected to an input of an infra-red amplifier 116 which powers an infra-red LED 117. The infra-red LED 117 acts as the transmission end of the infra-red link 9.

Contact 114 is connected to an input of a radio-frequency transmitter amplifier 118 whose output is fed to an aerial 119 which forms the transmission end of the radio link 8.

The mode switch 103 is illustrated as being in the form of a button switch. Repeated pressing of the mode switch 103 may be used to cycle between the two transmission modes (transmission via the radio link 8, and transmission via the infra-red link 9). Two indicator lights (not shown) may be provided in order to indicate the transmission mode that is currently selected. Instead of being a button switch, the mode switch 103 could be a two-position switch which may be switched between, for example, a left position and a right position with the left position being associated with one transmission mode and the right position being associated with the other transmission mode.

The MPU 107 monitors the mode switch 103 to determine which transmission mode has been selected by the user. If the user has selected the radio transmission mode, the MPU 107 controls the switch 112 so that the MPU output 111 is connected to the contact 114. If the user has selected the infra-red transmission mode, the MPU 107 controls the switch 112 so that the MPU output 111 is connected to the contact 113.

The MPU 107 considers that each command switch 102 produces different input signals when depressed when the control device is in the different transmission modes. For example, a particular command switch 102 may be considered as producing an input signal for starting the vehicle engine 4 when the control device is in the radio transmission mode, and may be considered as producing

an input signal for opening the vehicle door 5 when the control device is in the infra-red transmission mode.

The MPU 107 takes each input signal that it receives from the switch bank 106 and encodes it using pulse position modulation (PPM) or pulse code modulation (PCM) to produce a command signal which is fed by the switch 112 to the infra-red amplifier 116 if the control device is in the infra-red transmission mode, and to the radio frequency transmitter amplifier 118 if the control device is in the radio transmission mode. If the command signal is fed to the amplifier 116, it is amplified and then output by the LED 117 on the infra-red link 9. If the command signal is fed to the amplifier 118, it is amplified and then fed to the aerial 119 so as to pass along the radio link 8.

Fig. 3 is a circuit diagram showing the electronics of the base station 2. A photodiode 201 forms the reception end of the infra-red link 9. An aerial 202 forms the reception end of the radio link 8.

A command signal received by the photodiode 201 is fed through an infra-red amplifier 203 to a mixer 204. A command signal received by the aerial 202 is amplified by a radio-frequency receiver amplifier 205 and then fed to the mixer 204. The mixer 204 feeds the command signals along line 206 to a microprocessor unit 207. Software for running the MPU 207 is stored in ROM 208 and is run with the assistance of RAM 209. The functioning of the MPU 207 is regulated by a clock pulse produced by an oscillator 210.

The base station 2 includes a battery 211 that is connected to a voltage regulator 212 in order to produce a regulated voltage Vcc which, as illustrated in Fig. 3, is fed to other circuit components so as to power them.

Each command signal received on line 206 by MPU 207 is decoded and an appropriate control signal is produced. The

control signals which are output from the MPU 207 are fed through a buffer 213 and a drive controller 214 and eventually exit from the base station 2 on output lines 215.

The output lines 215 are connected to the electronics of the vehicle 3.

The overall arrangement is such that, for example, pressing command switch 102a when the control device 1 is in the radio transmission mode has the effect of producing a control signal on the output lines 215 which instructs the vehicle electronics to start the vehicle engine 4. If the mode switch 103 is then pressed so as to change transmission mode to the infra-red transmission mode, the act of pressing the command switch 102a will now have the effect of producing a control signal on the output lines 215 which instructs the vehicle electronics to open the vehicle door 5. Another one of the command switches 102 may be used, when the control device 1 is in the infra-red transmission mode, to produce a control signal on the output lines 215 which instructs the vehicle electronics to lower the vehicle ramp 6.

The MPU 207 is programmed so that, when it receives a command signal on the infra-red link 9, after it has received a command signal on the radio link 8, it responds to the command signal received via the infra-red link 9 by, in addition to outputting on the output lines 215 the control signal appropriate to the command signal received via the infra-red link 9, a control signal which has the effect of cancelling the control signal previously produced in response to the command signal received via the radio link 8. By way of practical example, pressing the command switch 102a a first time, when in the radio transmission mode, and then pressing the command switch 102a a second time, when in the infra-red transmission mode, has the effect of the base station 2 instructing the vehicle 3 firstly to

start the vehicle engine 4 and then at a later time to open the door 5 whilst turning off the engine 4.

A disabled person could carry the control device 1 with them when moving around in a wheelchair. Whilst a relatively long way away from the vehicle 3, e.g., whilst sufficiently far away to be out of sight of the vehicle 3, the disabled person could use the control device 1 to send a command via the radio link 8 so as to start the engine 4 in order to warm up the vehicle 3. Sometime later, the disabled person would return towards the vehicle 3 and, when a comparatively short distance away and when within sight of the vehicle, the disabled person could use the control device 1 to send a command via the infra-red link 9 so as to open the door 5 and indirectly turn off the engine 4. The disabled person would then enter the vehicle 3 and close the door 5, whereupon the disabled person could insert an ignition key into the ignition switch of the vehicle in the usual manner and thereby restart the engine ready for driving away.

CLAIMS

1. A portable control device for communicating with a base station, the portable control device comprising:

a first, radio transmitter;

a second, infra-red or ultrasonic transmitter;

first control circuitry; and

input means operable to input a first input signal to the first control circuitry and operable to input a second input signal to the first control circuitry;

wherein the first control circuitry is responsive to the first input signal to cause the first transmitter to transmit a first command signal and is responsive to the second input signal to cause the second transmitter to transmit a second command signal.

2. A portable control device according to claim 1, wherein the input means comprises first and second command switches operable to input the first and second input signals, respectively, to the first control circuitry.

3. A portable control device according to claim 1, wherein the input means comprises a command switch and a mode switch which is operable to switch the portable control device between first and second operational modes, and the command switch is operable, when the portable control device is in its first operational mode, to input the first input signal to the first control circuitry and is operable, when the portable control device is in its second operational mode, to input the second input signal to the first control circuitry.

4. A portable control device according to any one of claims 1 to 3, further comprising a casing which is holdable in a user's

hand and is disposed around the first and second transmitters, the first control circuitry and the input means.

5. A portable control device according to claim 4, wherein the input means is arranged relative to the casing so as to be operable by a user's hand when that hand is holding the casing.

6. A control system comprising a portable control device according to any one of claims 1 to 5 and a base station, wherein the base station comprises:

a first, radio receiver;

a second, infra-red or ultrasonic receiver; and

second control circuitry which is responsive to the first receiver receiving the first command signal to output a first control signal and is responsive to the second receiver receiving the second command signal to output a second control signal.

7. A control system according to claim 6, wherein the second control circuitry is responsive to the second receiver receiving the second command signal to cancel the first control signal.

8. A combination of a vehicle and a control system according to claim 6 or 7, wherein the base station is fitted to the vehicle and the vehicle is responsive to the first control signal to perform a first vehicle function and is responsive to the second control signal to perform a second vehicle function.

9. A method of communicating between a portable control device and a base station, wherein command signals are transmitted from the portable control device to the base station via a radio link and an infra-red or ultrasonic link and the portable control device allocates each command signal to one of the links.

10. A method according to claim 9, wherein the portable control device has a first operational mode in which command signals are allocated only to the radio link and a second operational mode in which command signals are allocated only to the infra-red or ultrasonic link, and during transmission of the command signals a mode switch is operated so that the portable control device is switched between the first and second operational modes.

11. A method according to claim 10, wherein the portable control device has a plurality of command switches each of which is operable to trigger the transmission of (i) a respective one of a group of first command signals when the portable control device is in its first operational mode and (ii) a respective one of a group of second command signals when the portable control device is in its second operational mode, and during transmission of the command signals the or each one of at least one of the command switches is operated when the portable control device is in each mode.

12. A method according to any one of claims 9 to 11, wherein during transmission of the command signals the portable control device is held in a user's hand.

13. A method according to claim 12 when dependent on claim 11, wherein the user's hand that is holding the portable control device is also used to operate the mode and command switches.

14. A method of controlling the output of a base station, comprising:

transmitting command signals from a portable control device to the base station by using a method according to any one of claims 9 to 13; and

responding to the command signals by outputting control signals from the base station.

15. A method according to claim 14, wherein the base station responds to a command signal transmitted via the infra-red or ultrasonic link by cancelling control signal(s) previously outputted in response to command signal(s) transmitted via the radio link.

16. A method of remotely controlling a vehicle, comprising:

transmitting command signals from a portable control device to a base station fitted to the vehicle, by using a method according to any one of claims 9 to 13; and

responding to the command signals by performing respective vehicle functions.

17. A method according to claim 16, wherein one of the vehicle functions comprises opening a door of the vehicle and another one of the vehicle functions comprises starting an engine of the vehicle.

18. A method according to claim 17, wherein the command signal for the vehicle function of opening the door of the vehicle is transmitted via the infra-red or ultrasonic link, and the command signal for the vehicle function of starting the engine of the vehicle is transmitted via the radio link.

19. A method according to any one of claims 16 to 18, wherein, in response to a command signal transmitted via the infra-red or ultrasonic link, vehicle function(s) performed previously in response to command signal(s) transmitted via the radio link are cancelled.

20. A method according to any one of claims 9 to 19, wherein the radio link is replaced by a long-range, non-line-of-sight link and the infra-red or ultrasonic link is replaced by a short-range, line-of-sight link.

21. A portable control device for communicating with a base station, substantially as herein described with reference to, or with reference to and as illustrated in, the accompanying drawings.

22. A control system substantially as herein described with reference to, or with reference to and as illustrated in, the accompanying drawings.

23. A combination of a vehicle and a control system, substantially as herein described with reference to, or with reference to and as illustrated in, the accompanying drawings.

24. A method of communicating between a portable control device and a base station, substantially as herein described with reference to the accompanying drawings.

25. A method of controlling the output of a base station, substantially as herein described with reference to the accompanying drawings.

26. A method of remotely controlling a vehicle, substantially as herein described with reference to the accompanying drawings.

Patents Act 1977 18
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9501937.8

Relevant Technical Fields

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(ii) Int Cl (Ed.6) H04B

Search Examiner
MR N HALL

Date of completion of Search
29 MARCH 1995

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE: WPI

Documents considered relevant following a search in respect of Claims :-
1-26

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 1426492	(MATSUSHITA) whole document	1,9 at least
X	US 5138649	(KRISBERGH) whole document	1,9 at least
X	DE 4300600 A1	(HUECK) whole document	1,9,16 at least

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